

**University of Mumbai**  
**Power Electronic Devices and Circuits**  
 Course Code: EEC404

**MCQ**

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
1.	Choose the most preferred method to turn on the SCR.
Option A:	gate triggering method
Option B:	dv/dt triggering method
Option C:	forward voltage triggering method
Option D:	temperature triggering method
2.	Select a fully controllable semiconductor switch operating at 100kHz that you would prefer for a switched mode power supply of 100W power level.
Option A:	Power BJT
Option B:	Power diode
Option C:	SCR
Option D:	Power MOSFET
3.	The input voltage to a Boost dc to dc converter is 12V. Find the average inductor current to supply 180W at 36V to a resistive load. All components are ideal.
Option A:	5A
Option B:	9.6A
Option C:	15A
Option D:	3A
4.	Find the highest average output voltage that can be obtained from a single phase fully controlled rectifier fed from 220V, 50Hz supply, feeding a resistive load.
Option A:	140V
Option B:	198V
Option C:	99V
Option D:	220V
5.	Choose the correct statement
Option A:	MOSFET has a negative temperature co-efficient
Option B:	MOSFET has a low gate circuit impedance
Option C:	MOSFET is a voltage controlled device
Option D:	MOSFET is a current controlled device
6.	In forced commutation of SCR, the commutating elements do not carry the load current in ..... commutation and current can be transferred between two loads in ..... commutation.
Option A:	Class A, Class C
Option B:	Class B, Class C
Option C:	Class A, Class F
Option D:	Class B, Class F

7.	In single pulse width modulation, harmonic distortion is ..... as compared to multiple pulse width modulation
Option A:	increased
Option B:	reduced
Option C:	equal
Option D:	zero
8.	When a Buck dc to dc converter was assembled and tested in the laboratory, the output side inductor was getting heated too much. What could be the reason for this?
Option A:	High value of inductor than desired
Option B:	Low value of inductor than desired
Option C:	High value of capacitor than desired
Option D:	Low value of capacitor than desired
9.	..... is a direct method of current measurement.
Option A:	Rogowski Coil
Option B:	Hall effect sensor
Option C:	Inductance dc resistance
Option D:	Current transformer
10.	Choose the wrong statement for an LED driver circuit.
Option A:	Regulates the current flowing through LED
Option B:	LED light output is proportional to its current
Option C:	Has an inbuilt rectifier if input is AC
Option D:	Decreases the lamp life of the LED
11.	Among the following ..... is a four quadrant converter
Option A:	Bidirectional PWM rectifier
Option B:	Fully controlled rectifier with inductive load
Option C:	Single phase half controlled rectifier with inductive load
Option D:	Three phase fully controlled rectifier with inductive load
12.	For Sinusoidal PWM, the lowest order harmonic frequency in the output voltage is around ....., if switches are operated at 10kHz and the modulating signal frequency is 50Hz.
Option A:	150Hz
Option B:	10kHz
Option C:	5kHz
Option D:	250Hz
13.	Which among the following needs to be calculated by the user for the heat sink selection?
Option A:	Maximum junction temperature of device
Option B:	Maximum power dissipated in the device
Option C:	Junction-to-case thermal resistance of device
Option D:	Maximum ambient temperature
14.	Level shifters are used to ..... in an inverter.

Option A:	drive a high-side switch
Option B:	drive a low-side switch
Option C:	Drive both high and low-side switch
Option D:	Provide only isolation
15.	A Buck-Boost dc to dc converter operates in continuous conduction mode with input voltage of 48V, load resistance of $24\Omega$ and switching frequency of 25kHz. If switch ON duration is $10\mu s$ , find the output voltage?
Option A:	64V
Option B:	12V
Option C:	16V
Option D:	24V
16.	di/dt protection is provided to the SCR by .....
Option A:	connecting an inductor in parallel with SCR
Option B:	connecting an inductor in series with SCR
Option C:	connecting a capacitor in series with SCR
Option D:	connecting a capacitor in parallel with SCR
17.	A single phase half controlled rectifier (common cathode) with a freewheeling diode is supplying a resistive load of $10\Omega$ . The input voltage is 230V, 50 Hz. The triggering angle is $30^\circ$ . The average current through the freewheeling diode is .....
Option A:	18.22A
Option B:	20.17A
Option C:	14.26A
Option D:	0A
18.	In a single phase fully controlled rectifier, in the inversion mode of operation electrical power flows from the ----- side to the -----side and firing angle is .....
Option A:	source to load, greater than $90^\circ$
Option B:	load to source, greater than $90^\circ$
Option C:	source to load, lesser than $90^\circ$
Option D:	load to source, lesser than $90^\circ$
19.	To turn OFF an SCR, the anode current must be brought below -----current and a reverse voltage must be applied for a time larger than ----- time of the device.
Option A:	holding, turn off
Option B:	holding, turn on
Option C:	latching, turn off
Option D:	latching, turn on
20.	What is the peak voltage across each switch in a single phase full bridge inverter if the input voltage (DC) is 24V.
Option A:	48V
Option B:	24V
Option C:	12V
Option D:	96V
21.	The GaN and SiC devices are also known as _____.
Option A:	Wide band Gap devices

Option B:	Electroluminescence devices
Option C:	Photovoltaic devices
Option D:	Electrolytic devices
22.	The conduction losses in the semiconductor devices depends on
Option A:	On state voltage or on state resistance
Option B:	The applied voltage
Option C:	The load resistance
Option D:	Switching time
23.	Which of the following is not the characteristics of ideal controllable switch
Option A:	Switch from on to off or vice versa instantaneously when triggered
Option B:	Conduct arbitrarily large currents with zero voltage drop when on
Option C:	Block arbitrarily large current with zero voltage drop when on
Option D:	Very large power required from control source to trigger the switch
24.	Safe operating area (SOA) of power transistor specifies the safe operating limits of
Option A:	Base current $I_b$ and base emitter voltage $V_{be}$
Option B:	Collector current $I_c$ and collector emitter voltage $V_{ce}$
Option C:	Base current $I_b$ and collector emitter voltage $V_{ce}$
Option D:	Collector current $I_c$ and base emitter voltage $V_{be}$
25.	In a SCR, forward leakage current flows when
Option A:	Junctions $J_1, J_3$ are reverse biased but junction $J_2$ is forward biased
Option B:	Junctions $J_1, J_2$ are forward biased but junction $J_3$ is reverse biased
Option C:	Junctions $J_1, J_3$ are forward biased but junction $J_2$ is reverse biased
Option D:	Junctions $J_2, J_3$ are forward biased but junction $J_1$ is reverse biased
26.	The forward voltage at which SCR switches to on state depends upon
Option A:	Magnitude of Gate current
Option B:	Magnitude of anode current
Option C:	Magnitude of anode to cathode voltage
Option D:	Both anode current and anode voltage
27.	Commutation failure occurs in power electronic devices if
Option A:	Circuit turns off time $t_c$ is smaller than thyristor turn off time $t_q$
Option B:	Circuit turns off time $t_c$ is greater than thyristor turn off time $t_q$
Option C:	Circuit turns off time $t_c$ is equal to thyristor turn off time $t_q$
Option D:	If $di/dt$ is high
28.	Which one provides four quadrant operation?
Option A:	Bidirectional PWM rectifier
Option B:	Fully controlled rectifier with inductive load
Option C:	Single phase half controlled rectifier with inductive load
Option D:	Three phase fully controlled rectifier with inductive load
29.	A freewheeling Diode in a phase-controlled converter
Option A:	Provides an alternative path for the decay of load current
Option B:	Causes poor voltage regulation
Option C:	Enables inverter operation

Option D:	Has poor power factor
30.	A single-phase transformer with secondary voltage of 230 V, 50 Hz, delivers power to a lamp with resistance $10 \Omega$ through a half-wave-controlled rectifier circuit. For $\alpha=45^\circ$ find the average current in the lamp.
Option A:	78.9 A
Option B:	9 A
Option C:	7.89 A
Option D:	76.8 A
31.	Choose a false statement for single phase bridge Inverter with resistive load
Option A:	Switches can have diodes in antiparallel
Option B:	It uses two transistor switches
Option C:	It uses 2-wired DC source
Option D:	Current do not flow through antiparallel diodes
32.	For a current source inverter, which parameter is independent of nature of load impedance
Option A:	Magnitude of output voltage
Option B:	Nature of output voltage waveform
Option C:	Amplitude of output current
Option D:	Power delivered to load
33.	Which of the following is not a PWM technique used in inverter to control the output voltage?
Option A:	Single-pulse width modulation
Option B:	Multiple-width modulation
Option C:	Triangular carrier with dc control voltage
Option D:	Sinusoidal-pulse width modulation
34.	In Inverter $120^\circ$ conduction mode of operation is preferred over $180^\circ$ conduction mode because
Option A:	It reduces the number of steps in output voltage waveform
Option B:	It avoids direct short circuit across DC source
Option C:	It increases the number of steps in output voltage waveform
Option D:	It causes direct short circuit across DC source
35.	Buck-boost converter acts as a boost converter for duty cycle is equal to
Option A:	0.7
Option B:	0.2
Option C:	0.1
Option D:	0.4
36.	For a step-up chopper when duty cycle is decreased the average value of output voltage
Option A:	increases
Option B:	decreases
Option C:	Remains same
Option D:	Either increase or decrease

37.	A Buck-Boost dc to dc converter operates in continuous conduction mode with input voltage of 48V, load resistance of 24Ω and switching frequency of 25kHz. If switch ON duration is 10μs, find the output voltage?
Option A:	64V
Option B:	12V
Option C:	16V
Option D:	24V
38.	A heat sink is generally used with a transistor to _____
Option A:	increases the forward current
Option B:	decrease the forward current
Option C:	compensate for excessive doping
Option D:	prevent excessive temperature rise
39.	For a given transistor, the thermal resistance is 8°C/W and for the ambient temperature $T_a=27^\circ\text{C}$ . If the transistor dissipates 3W of power, calculate the junction temperature $T_j$ .
Option A:	51°C
Option B:	27°C
Option C:	67°C
Option D:	77°C
40.	In switching power supplies Gate drivers are used because _____
Option A:	They orchestrate the carefully timed switching of an array of high-power transistors.
Option B:	They can drive power transistors at hundreds of megahertz
Option C:	They amplify a low voltage or low current signal from a micro-controller
Option D:	they are prohibitively slow and inefficient
41.	A thyristor can be brought from the forward conduction mode to forward blocking mode by _____ preferably.
Option A:	dv/dt triggering method
Option B:	applying a negative gate signal
Option C:	applying a positive gate signal
Option D:	applying a reverse voltage across anode-cathode terminals
42.	The forward break over voltage is maximum when _____.
Option A:	Gate current = $\infty$
Option B:	Gate current = 0
Option C:	Gate current $\geq 1$
Option D:	Gate current is applied for more than 3msec.
43.	di/dt protection is provided to the thyristor by _____.
Option A:	connecting an inductor in parallel across the load
Option B:	connecting an inductor in series with the load
Option C:	connecting an inductor in parallel across the gate terminal
Option D:	connecting an inductor in series with the gate
44.	Class C commutation uses _____ number of SCR.
Option A:	1
Option B:	4

Option C:	2
Option D:	3
45.	The power electronics devices have a very high efficiency because _____.
Option A:	cooling is very efficient
Option B:	the devices traverse active region at high speed & stays at the two states, on and off
Option C:	the devices never operate in active region
Option D:	the devices always operate in the active region
46.	The GaN and SiC devices are also known as_____.
Option A:	Wide band Gap devices
Option B:	Electroluminescence devices
Option C:	Photovoltaic devices
Option D:	Electrolytic devices
47.	Freewheeling diodes in phase controlled rectifiers _____.
Option A:	Enable inverter operation
Option B:	Adds reactive power
Option C:	Improves line power factor and disables inversion mode operation
Option D:	Adds harmonics
48.	For a firing angle of 60 degree, in respect of a single phase half wave controlled rectifier with resistive load, supply from a 230 V (RMS), 50 Hz supply, the average output voltage would be _____.
Option A:	77.5 V
Option B:	52 V
Option C:	155V
Option D:	104V
49.	In a three phase controlled bridge rectifier, the maximum conduction of each thyristor is _____.
Option A:	60°
Option B:	30°
Option C:	90°
Option D:	120°
50.	In a dual converter _____.
Option A:	The circulating current allows smooth reversal of load current, but increases the response time.
Option B:	The circulating current allows smooth reversal of load current with improved speed of response
Option C:	The circulating current does not allow smooth reversal of load current.
Option D:	The circulating current flows if there is no interconnecting inductor.
51.	A bidirectional PWM rectifier uses _____controllable switches.
Option A:	1
Option B:	2
Option C:	3
Option D:	4

52.	The output voltage from a single phase full wave bridge inverter varies from_____.
Option A:	$V_s$ to $-V_s$
Option B:	$V_s$ to zero
Option C:	$V_s/2$ to zero
Option D:	$-V_s/2$ to $V_s/2$
53.	The fundamental component of output voltage for a half wave bridge inverter is given by_____.
Option A:	$(4V_s/\pi) \sin\omega t$
Option B:	$(2V_s/\pi) \sin\omega t$
Option C:	$(V_s/2\pi) \sin\omega t$
Option D:	$(V_s)$
54.	In the three-phase bridge inverter, each step consists of _____.
Option A:	$60^\circ$
Option B:	$120^\circ$
Option C:	$90^\circ$
Option D:	will depend on the value of the firing angle
55.	What is the duty cycle of a chopper?
Option A:	$T_{on}/T_{off}$
Option B:	$T_{on}/T$
Option C:	$T/T_{on}$
Option D:	$T_{off} \times T_{on}$
56.	Find the output voltage for a step-up chopper when it is operated at a duty cycle of 50 % and $V_s = 240$ V.
Option A:	480
Option B:	240
Option C:	560
Option D:	520
57.	An ideal Boost converter is a DC/DC converter that has output current magnitude that is_____ the input current magnitude.
Option A:	equal to
Option B:	either greater than or lesser than
Option C:	greater than
Option D:	lesser than
58.	A step down chopper has input dc voltage of 220V and $R = 10\Omega$ in series with $L=65$ mH. If the load current varies linearly between 11 A and 17 A, then find the duty cycle $\alpha$ .
Option A:	1
Option B:	0.4
Option C:	0.7
Option D:	0.3
59.	Why resistors are used in Snubber circuits?
Option A:	To minimize losses
Option B:	To minimize charging current

Option C:	To minimize discharging current of capacitor
Option D:	To minimize leakage current
60.	_____ material is used in heat sink.
Option A:	Aluminum
Option B:	Iron
Option C:	Carbon
Option D:	silver

### **DESCRIPTIVE QUESTIONS**

1.	A single phase fully controlled bridge rectifier is operated with R-L load. Draw the diagram of the rectifier, output voltage waveform and derive the average output voltage.
2.	Draw the following waveforms of a Boost dc to dc converter: (i) Inductor voltage; (ii) Inductor current; (iii) Capacitor current; (iv) Capacitor voltage and (v) Switch current.
3.	Compare single phase half bridge inverter and full bridge inverter (any five points)
4.	What is a bootstrap driver circuit? Why it is needed?
5.	Compare power MOSFET & IGBT (any five points).
6.	Briefly explain Class A commutation method of SCR
7.	Explain the switching characteristics of IGBT and comment on its important specification parameters
8.	Explain Complementary commutation of SCR with the help of circuit diagram and appropriate waveform.
9.	Draw the circuit diagram of 3-phase full wave converter with R-load and explain firing sequence of thyristors.
10.	Explain Boost switching regulator and derive equation for output voltage
11.	Give comparison of voltage source inverter and current source inverter
12.	Explain Turn on snubber for Thyristor protection.
13.	Compare PWM rectifier with thyristor rectifier.
14.	Compare GaN and SiC devices.
15.	Explain UJT triggering circuit used for SCR.
16.	Explain di/dt and dv/dt protection circuits in brief.
17.	Compare CSI and VSI.
18.	Explain the working of single phase half wave controlled rectifier circuit (feeding RL load) with diagram and relevant waveform for $\alpha=60^\circ$ .
19.	Draw the diagram of a single phase controlled rectifier in midpoint configuration feeding a resistive load and do the following: (i) draw the waveforms of supply voltage, output voltage and output current for a firing angle of $90^\circ$ ; (ii) Derive the average output voltage in terms of firing angle and (iii) Derive the RMS output voltage in terms of firing angle.
20.	In a Buck-Boost converter, the switch is operated at 10kHz. Given that $C=100\mu\text{F}$ , input voltage=16V and load resistance is $12\Omega$ . If the output voltage required is two times the input voltage, calculate (a) duty cycle; (b) input current; (c) average inductor current; (d) value of inductor if current ripple is 20% of the average inductor current and (e) output voltage ripple. All components are ideal.
21.	Describe the working of three phase bridge Inverter for $180^\circ$ conduction mode and draw the gating signals and phase voltages.

22.	Draw the circuit diagram of 3-phase Inverter and explain its operation in 120° mode of conduction
23.	Explain Power Factor improvement scheme using DC to DC converter
24.	Explain operation of single phase fully controlled full wave converter with R-L load with appropriate circuit diagram and waveforms. Derive the expression for average output voltage.
25.	Draw a neat circuit and explain the working of 3 phase full wave fully controlled bridge rectifier circuit with resistive load. Draw the supply and output voltage waveforms in a graph sheet.
26.	Draw and explain any two commutation circuits of SCR along with waveforms. Also write the difference between them.
27.	Write a short notes on (a) Snubber circuits (b) Heat sinks
28.	Explain working of Buck-Boost converter circuit with neat diagram and waveforms for power conversion. Also explain LED lamp driver circuit in brief.